WHAT IS CLAIMED IS:

1. A method for processing a multi-carrier signal transmitted across a channel, comprising

receiving the multi-carrier signal in time domain;

estimating a channel transfer function using a subset of the multi-carrier signal in time domain;

transforming the multi-carrier signal from time-domain into frequency domain; and

compensating for the channel transfer function using the estimated channel transfer function.

2. The method of claim 1 wherein the subset of the multi-carrier signal in time domain comprises training symbols.

3. The method of claim 2 wherein the estimating step comprises performing a convolution of the training sequence.

4. The method of claim 3 wherein the estimating step further comprises processing a weighing matrix in time domain.

5. The method of claim 4 wherein the processing of the weighing matrix comprises performing a multiplication of the weighing matrix with the convolved training sequence.

6. The method of claim 5 wherein the weighing matrix comprises values that account for the finite time response of the channel and the position of zero sub-carriers in the frequency domain.

7. The method of claim 2 wherein the convolution is performed as a non-cyclical convolution.

8. The method of claim 5 wherein the estimating step further includes determining an optimum time window within which the multiplication of the weighing matrix occurs.

9. The method of claim 1 wherein the multi-carrier signal is developed using orthogonal frequency division multiplexing.

10. The method of claim 9 wherein the channel comprises a wireless multi-path channel.

11. A channel estimation method comprising:

receiving a time-domain multi-carrier signal representing a channel training sequence;

performing a cyclic convolution function on the training sequence;

extracting a time window within which the received signal has optimum amount of energy; and

multiplying a weighing matrix with the convolved training sequence to arrive at channel estimates, wherein, the multiplying occurs during the time window extracted by the extracting step.

12. The channel estimation method of claim 11 wherein the weighing matrix comprises values that represent an amount of non-zero time samples of an impulse response of the channel.

13. A method for communicating data between a transmitter and a receiver separated by a channel, the method comprising:

at the transmitter end:

generating a plurality of modulated sub-carrier signals based on the data;

transforming the plurality of modulated sub-carrier signals into a plurality of time-domain signals;

transmitting the plurality of time-domain signals across the channel; and

at the receiver end:

receiving the multi-carrier signal in time domain;

estimating a channel transfer function using a subset of the multi-carrier signal in time domain;

transforming the multi-carrier signal from time-domain into frequency domain; and

compensating for the channel transfer function using the estimated channel transfer function.

14. The method of claim 13 the estimating comprises performing a cyclic convolution on a training sequence embedded in the subset of the multi-carrier signal in time domain.

15. The method of claim 14 wherein the estimating further comprises multiplying a weighing matrix with the convolved training sequence.

16. The method of claim 15 wherein the step of multiplying occurs at a window of time during which the multi-carrier signal has optimum energy.

17. In a multi-carrier data communication system, a receiver comprising:

a channel estimator that receives a multi-carrier time-domain signal at an input and generates a plurality of channel estimates at an output;

a time-domain to frequency-domain transform unit coupled to the output of the channel estimator and configured to convert the multi-carrier time-domain signal and the channel estimates from time domain into frequency domain; and

an equalizer coupled to an output of the transform unit and configured to compensate the multi-carrier signal for channel effects using the channel estimates.

18. The receiver of claim 17 wherein the channel estimator comprises:

a correlator coupled to receive a training sequence embedded in the multi-carrier time-domain signal, and configured to perform a convolution operation on the training sequence; and

a multiplier coupled to the correlator and configured to multiply a channel estimation weighing matrix with an output of the correlator.

19. The receiver of claim 18 wherein the channel estimation weighing matrix comprises values that account for the finite time response of the channel and the position of zero sub-carriers in the frequency domain.

20. The receiver of claim 19 wherein the estimator further comprises a timing circuit coupled to the correlator and the multiplier, and configured to extract an optimum time for the multiplication performed by the multiplier.

21. The receiver of claim 20 wherein the correlator comprises a matched filter that performs a cyclic convolution.

22. The receiver of claim 21 wherein the matched filter is also configured to acquire timing of received signal for synchronization purposes.

23. The receiver of claim 20 wherein the estimator further comprises a memory unit coupled to the correlator and configured to store the output of the correlator.

24. The receiver of claim 23 wherein the estimator further comprises:

a delay unit having an input coupled to the input of the channel estimator and an output; and

a multiplexer having a first input coupled to the output of the delay unit, a second input coupled to an output of the multiplier, a control input and an output,

wherein, the multiplexer is configured to combine a payload portion of the multi-carrier time-domain signal with the plurality of channel estimates.

25. The receiver of claim 25 wherein the time-domain to frequency-domain transform unit is configured to perform a fast Fourier transform function.

26. A multi-carrier data communication system comprising:

a transmitter including:

a demodulator/deserializer configured to convert an input data stream into a parallel plurality of multi-carrier signals;

a frequency-domain to time-domain converter having an input coupled to the modulator/deserializer and configured to transform the parallel plurality of multi-carrier signals from frequency domain into time domain at an output;

a guard period insertion block coupled to the frequency-domain to time-domain converter and configured to insert a guard period in the output of the frequency-domain to time-domain converter;

a serializer coupled to an output of the guard period insertion block and configured to perform a parallel to serial conversion on the signal; and

a digital-to-analog converter coupled to the serializer and configured to convert the digital signal into an analog signal and to transmit the analog multi-carrier time-domain signal across a channel;

a receiver including:

an analog-to-digital converter coupled to receive the analog signal and configured to convert the analog signal into a digital signal;

a deserializer coupled to the analog-to-digital converter and configured to convert the digital signal into a plurality of parallel signals;

a channel estimator coupled to the deserializer and configured to derive channel estimates using a training sequence embedded into to received time–domain signal;

a guard period removal block coupled to an output of the channel estimator and configured to remove the guard period;

a time-domain to frequency-domain converter coupled to an output of the guard period removal block;

an equalizer coupled to the time-domain to frequency-domain converter and configured to equalize the signal using the channel estimates;

a serializer/demodulator coupled to an output of the equalizer and configured to generate an output data stream.

27. The data communication system of claim 26 wherein the channel estimator comprises:

a correlator coupled to receive a training sequence embedded in the multi-carrier time-domain signal, and configured to perform a convolution operation on the training sequence; and

a multiplier coupled to the correlator and configured to multiply a channel estimation weighing matrix with an output of the correlator.

28. The receiver of claim 27 wherein the channel estimator further comprises a timing circuit coupled to the correlator and the multiplier, and configured to extract an optimum time for the multiplication performed by the multiplier.

29. The receiver of claim 28 wherein the correlator comprises a matched filter that performs a cyclic convolution.

30. The receiver of claim 29 wherein the matched filter is also configured to acquire timing of received signal for synchronization purposes.